

# PATENT SPECIFICATION



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## PROVISIONAL SPECIFICATION

### Improvements in Lightning Arresters

We, JOHN BENTLEY HANSELL, of 121, Eccles Old Road, Pendleton, Manchester, in the County of Lancaster, a subject of the King of Great Britain, and ASSOCIATED ELECTRICAL INDUSTRIES LIMITED, of Crown House, Aldwych, in the City of Westminster, a British Company, do hereby declare the nature of this invention to be as follows:—

10 This invention relates to lightning arresters and has for its object an improved arrangement suitable for use with a terminal bushing of an enclosed electrical apparatus such as a high voltage transformer.

According to the invention the actual elements of the lightning arrester such as a block of "Thyrite" (which is a registered Trade Mark) and spark gaps are located in an annular housing of porcelain or other insulating material through the centre of which passes a terminal conductor rod such as of a transformer so that said housing serves also as a terminal bushing. The "Thyrite" block or the equivalent and also the spark gaps are preferably in annular form. The annular housing is preferably closed at the top and open underneath where it is closed upon its contents by means for example of a metal washer which may be held in position such as by a spring ring engaged in a groove in the housing. The closure may if desired be sealed with cement or other-

wise. The other end of the housing may be covered with a metal cap which is fixed to the terminal rod, which plate has one or preferably three projections or studs extending downwards through holes in the housing into the annular space therein where they are engaged by the end plate of one or more spark gaps which may be disposed in small porcelain cylinders the other end plate of said gaps engaging the annular block of "Thyrite" and a spring washer being interposed between said block and the closure plate to which an earthing terminal can be applied such as for connection to a transformer tank.

The "Thyrite" block is moulded of a dense inorganic compound of a ceramic nature and possesses the property that at and below a certain voltage it is a good insulator but becomes a comparatively good conductor at higher voltages. The invention however is not limited to the use of "Thyrite" since other devices such as de-ion gaps can be used if capable of being enclosed in the annular housing. The latter may be mounted for example in or over a hole in a transformer tank.

Various minor modifications may be made within the scope of the invention.

Dated the 1st day of September, 1933.

F. W. LE TALL, Chartered Patent Agent, 2, Norfolk Street, Strand, London, W.C., Agent for the Applicants.

## COMPLETE SPECIFICATION

### Improvements in Lightning Arresters

We, JOHN BENTLEY HANSELL, of 121, Eccles Old Road, Pendleton, Manchester, in the County of Lancaster, a subject of the King of Great Britain, and ASSOCIATED ELECTRICAL INDUSTRIES LIMITED, of Crown House, Aldwych, in the City of Westminster, a British Company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in any by the following statement:—

This invention relates to lightning arresters, namely devices for protecting

electrical apparatus against electrical disturbances, due to lightning or other causes, on the conductors connected with said apparatus, and the invention has for its object an improved arrangement suitable for use with a terminal bushing of an enclosed electrical apparatus such as a high voltage transformer.

According to the invention the actual elements of the lightning arrester such as a resistance and spark gaps are located in an annular housing of porcelain or other insulating material through the centre of which passes a terminal conductor rod

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such as that of a transformer so that said housing serves also as a terminal bushing. The resistance and the spark gaps are preferably in annular form, whilst the annular housing is preferably closed at the top and open underneath where it is closed upon its contents by means for example of a metal washer which may be held in position such as by a spring ring engaged in a groove in the housing.

In order that the invention may be clearly understood and readily carried into effect it will now be described by way of example with reference to the accompanying drawing, the single figure of which is a sectional elevation of one embodiment of the combined lightning arrester and terminal bushing.

In the drawing the annular housing is indicated at 1 and is secured by means of a clamping ring partly shown at 2 in a perforation provided in the enclosing tank of the electrical apparatus, such as a high voltage transformer, part of which tank is indicated at 3. The upper end of the housing 1 is covered by a metal cap 4 through which extends the terminal rod 5 to which the line conductor (not shown) is adapted to be connected, said terminal rod extending through a central sleeve 6 depending from and formed integrally with the closed top 7 of the housing 1, said rod 5 and cap 4 being secured in place by nuts 8. One or more studs are secured to the metal cap 4 and extend through perforations provided in the portion 7 of the housing 1, two such studs being shown at 9 in the drawing. Said projections or studs 9 extend into the annular space 10 of the housing 1 in which space are located the actual elements of the lightning arrester.

The lightning arrester comprises an annular metal plate 11 with which the projections or studs 9 project into contacting engagement, said plate 11 carrying on its under side the electrodes of one or more spark gaps, two such electrodes being indicated in the drawing at 12 and 13. The other electrode of each of the spark gaps, which electrodes are indicated at 14 and 15, is mounted upon a second annular metal plate 16 which is spaced from the plate 11 by means of small cylinders 17 of porcelain which surround the electrodes 11 to 15 and by an intermediate annular plate 18. An annular block 19 of the material known under the Registered Trade Mark as "Thyrite" is located below the said spark gap system, the upper end of said block being in engagement with the plate 16 and the lower end of said block being in engagement with a metal plate 20. The various elements above described of the lightning arrester are pressed

against one another by means of a spring washer 21 and held in place by a metal closure plate 22 which is held in place within the housing 1 by means of a retaining ring 23 received within a co-operating groove 24 provided in said housing. The closure plate 23 is connected to earth, for example, as illustrated in the drawing, by means of an electrical connection 25 which is secured on the one hand to said plate 22 and on the other hand to the transformer tank plate 2. The closure may if desired be sealed with cement or otherwise.

The resistance 19 is advantageously made of "Thyrite" which is moulded material composed of a dense inorganic compound of a ceramic nature and possesses the property that at and below a certain voltage it is a good insulator but becomes a comparatively good conductor at higher voltages. The invention however is not limited to the use of "Thyrite" since other devices such as deion gaps can be used if capable of being enclosed in the annular housing. A deion gap type of lightning arrester may comprise in series with a normal spark gap, spark gap electrodes located in a tube of fibre or the like which is open at the lower end, the arrangement being such that any discharge between the electrodes will take place inside the tube and not over the external surface thereof. With this arrangement, when a surge appears on the arrester, the two spark gaps are over, and if a power arc follows, the heat of such arc in the fibre tube causes vaporization of some of the fibre in the walls of the latter to produce gases which are not ionized. These gases are forced into the arc stream and the arc is extinguished as the alternating power current passes through zero.

In applying such deion gaps to a construction according to the present invention, a plurality of fibre tubes and spark gaps enclosed therein are located in circular formation in place of the block 19 of the drawing, whilst the plate 18 of the drawing may be omitted, the tubes 17 surrounding each gap being combined. Passageways or vents are formed leading from the lower ends of the fibre tubes to the exterior of the housing 1, to allow expulsion of the gases resulting from an arc. The electrostatic capacities across the two sets of spark gaps are arranged so that under normal conditions the voltage across the gaps located in the fibre tubes is considerably less than the voltage across the other spark gaps (corresponding to the gaps 12, 14 of the drawing) so that the electrical stress on the fibre tube is small. An annular block of a suitable

resistance material may be located between the projections or studs 9 and the plate 11 for the purpose of limiting the power current which may flow upon arc-over of the 5 gaps.

It is to be understood that various minor modifications may be made in the arrangement above described without departing from the scope of the invention.

10 Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

15 1. A lightning arrester in which the electrodes or elements forming the path for the high voltage discharge are enclosed in an annular cavity in a housing of insulating material surrounding a conductor 20 such as a lead-in conductor of a transformer or other enclosed electrical apparatus of which the housing serves also as an insulating bushing.

25 2. A lightning arrester as claimed in claim 1, in which the lightning arrester comprises a block of material the resistance of which changes with the applied voltage, which block is of annular form and spark gaps disposed in annular 30 formation.

3. A lightning arrester as claimed in claim 1 or claim 2, in which the housing is closed at the top and open at the lower end, a metal washer completing the enclosure of the lightning arrester 35 elements at said lower end of the housing.

4. A lightning arrester as claimed in claim 3, in which the upper end of the housing is covered by a metal cap electrically connected with the terminal conductor rod and with one side of the lightning arrester elements, the other side of which are in electrical contact with the metal washer closing the housing at the lower end, which metal washer is adapted 45 to be connected to earth for example through the enclosing tank of the electrical apparatus with which the lightning arrester is associated.

5. A combined lightning arrester and 50 terminal bushing for an enclosed electrical apparatus constructed substantially as herein described and shown in the accompanying drawing.

Dated the 25th day of June, 1934.

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2, Norfolk Street, Strand, London, W.C.,  
Agent for the Applicants.

*[This Drawing is a reproduction of the Original on a reduced scale.]*

